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A STUDY OF THE DEGRADATION OF MEVINPHOS (PHOSDRIN) IN AND ON THE LEAVES, HUSKS AND SILKS AND THE SOIL IN A FIELD OF SWEET CORN IN YOLO COUNTY, CALIFORNIA JULY 1976

By

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Mevinphos is a highly toxic organophosphate insecticide. The acute oral LD_{50} (rat) is approximately 3.7-6 mg/kg and the acute dermal LD_{50} (rat) is approximately 4.2-4.7 mg/kg. Toxic effects are related to blood and tissue cholinesterase inhibition.

Mevinphos is used to control aphids, mites, leafhoppers and many other insects on a broad range of field, forage, vegetable and fruit crops. In 1975 about 1,591 pounds of mevinphos were reported as applied to more than 3,253 acres of corn.

Mevinphos is sold under several trade names such as Phosdrin, Duraphos and Castle X-4. It is marketed in three formulations as an emulsifiable concentrate, a water-soluble solution and a dust. Phosdrin consists of 2 major isomers. The alpha-isomer is more toxic and constitutes 60% of the active ingredient, with the beta-isomer making up most of the remaining 40%. This study covers the breakdown of the water-soluble solution of Phosdrin. The label recommends using 1/4 to 1 pint of Phosdrin with a one-day preharvest interval. Workers are not allowed to reenter the fields until one day after spraying. The tolerance for Phosdrin on sweet corn is 1 ppm on forage and 0.25 ppm on the grain.

APPLICATION AND SAMPLING

Phosdrin was applied to an 84-acre field of sweet corn in the following manner by an airplane.

1 pt Phosdrin (1/2 lb. actual mevinphos)/acre
1/2 lb. Lannate/acre
10 gal. water/acre

The Lannate decay was reported in a separate study.

Triplicate leaf samples were taken 5, 29, 51 and 75 hours after application. Four samples were collected at the 21-hour interval. Each sample consisted of approximately 100 leaf punches, 2.5 cm in diameter. Samples were collected by following a diagonal pattern through the field. Duplicate

samples were analyzed for surface and penetrated residues, while the third sample was for total residue analysis.

For husk and silk analysis, six ears of corn were collected at the same intervals, following the same diagonal path. Surface soil samples were collected twice, also following the same diagonal pattern. These samples were all analyzed for total residue.

ANALYTICAL METHODS
(Extraction from Leaves, Husks and Silk)

The procedure used for the extraction of dislodgeable, penetrated, and total residues from leaf punches was originally published by Gunther in "The Bulletin of Environmental Contamination and Toxicology," 9, 243-249, 1973. It has been documented several times in detail, with modifications that were made to accommodate the various pesticides and their metabolites, that present potential hazards to human health.

The sample container and sample material were weighed and the gross weight recorded.

Total Residues

1. The sample materials were transferred to a blending jar. The empty sample container was again weighed and the net weight of the material recorded.

2. Approximately 50 gms of sodium sulfate and 100 mls of nano-ethyl acetate were added.

3. The sample was blended at high speed for 3 minutes, keeping the blender cup cool by immersing it in a container of cool water. The blender cup was removed and the sample allowed to settle.

4. An aliquot was decanted into a teflon-capped bottle and stored in the freezer prior to clean up and analysis.

Dislodgeable Residues

1. Fifty mls of water and approximately 4 drops of Sur-Ten solution (1:50) were added to the sample containers. The containers were capped and placed in a multi-purpose rotator and rotated at 30 cycles/min. for 60 min. The aqueous solution was decanted through a glass wool plug into a 500 ml separatory funnel.

2. The samples were rotated a second time, using 50 mls of water and 4 drops of Sur-Ten solution, for 30 min. This was added to the first extraction.

3. The sample was then hand-shaken for approximately 10 secs with 30 mls of water. The container was drained into the separatory funnel with the first two extractions.

4. The aqueous solution was extracted three times with 50 ml of nano-chloroform. The extract was filtered through sodium sulfate into a

glass-stoppered mixing cylinder and the volume was recorded. The extract was mixed carefully in the cylinder. An aliquot was decanted into a teflon-capped bottle and stored in the freezer prior to clean up and analysis.

Penetrated Residue

1. After the last water rinse was drained for the dislodgeable residue, the sample was transferred to a blender jar. The empty sample container was weighed and the net weight of the sample recorded.

2. Approximately 50 gms of sodium sulfate and 100 mls of nano-ethyl acetate were added.

3. The sample was blended and handled the same as the total residue sample.

ANALYTICAL METHODS (Extraction from Soil)

1. The soil sample was finely divided to remove or break up lumps. It was air dried, if necessary.

2. 10% water by weight was added and mixed well.

3. Extraction was with a 2:1:1 petroleum ether: ethyl ether: acetone mixture. The maximum amount compatible with the sample container was used so that there was free liquid over the soil.

4. The jar was placed on a rotator or shaker for 1 hour.

5. An aliquot was filtered for instrument analysis; this was concentrated, if necessary.

ANALYTICAL METHODS (Chromatography)

Samples were analyzed by gas chromatography with a Varian Series 2700 Gas Chromatograph equipped with a flame photometric detector in its phosphorus specific mode and the following conditions:

Column - 3% OV-275, 100/120 Chrom W (HP); 6' x 1/4" x 2 mm I.D.

Column temp.	-	175°C
Injector temp.	-	230°C
Detector temp.	-	230°C
Retention times	-	Alpha = 2.0 min
	-	Beta = 2.8 min

RESULTS

Daily temperature and weather observations are recorded on Table 1. The average maximum and minimum temperatures for the study period were 94.4 and 60.2°F, respectively.

Results of the analysis are given in Tables 2-4 and Figures 1-2. Phosdrin dissipates quickly. All leaf residues were below 1 ppm in 2-1/2 days. In 24 hours, surface residues on leaves were about 5 ppm. Silk and husk residues were below 0.1 ppm by about 50 hours post-application.

TABLE 1: DAILY TEMPERATURE

Date (1976)	Temperature (°F) Maximum	Minimum	Weather Conditions
7/19	89	60	Clear
20	95	58	Clear
21	92	58	Clear
22	98	59	Clear/cloudy
23	98	66	Cloudy/clear
Average	94.4	60.2	

There was no precipitation during the study period.

TABLE 2: PHOSDRIN RESIDUE ON SWEET CORN LEAVES

Date (1976)	Sample Interval	Surface Residue (PPM) Alpha	Beta	Penetrated Residue (PPM) Alpha	Beta	Total Residue (PPM) Alpha	Beta
7/20	5 hrs	7.1	2.6	0.83	0.8		
20	5 hrs	5.2	2.0	0.84	1.1		
20	5 hrs					8.1	4.5
21	29 hrs	7.1	0.5	0.1	0.1		
21	29 hrs	2.4	1.0	0.2	0.1		
21	29 hrs					2.6	2.1
21	29 hrs	2.6	1.1	0.1	0.1		
22	51 hrs	1.3	0.8	0.1	0.1		
22	51 hrs	1.3	0.7	0.1	0.1		
22	51 hrs					1.2	*
23	75 hrs	0.5	0.48	None detected	None detected		
23	75 hrs	0.5	0.3	0.1	None detected		
23	75 hrs					0.3	*

* Could not calculate because of an interfering peak.

TABLE 3: TOTAL PHOSDRIN RESIDUE ON SILK AND HUSKS OF SWEET CORN

Date (1976)	Sample Interval	Silk Residue (PPM)		Husk Residue (PPM)	
		Alpha	Beta	Alpha	Beta
7/20	5 hrs	0.2	0.2	0.1	0.1
21	29 hrs	0.14	0.12	0.1	0.1
22	51 hrs	0.1	0.1	None detected	None detected
23	75 hrs	None detected	None detected	None detected	None detected

TABLE 4: TOTAL PHOSDRIN RESIDUE IN SOIL FROM SWEET CORN FIELD

Date (1976)	Sample Interval	Total Phosdrin Residue (PPM)	
		Alpha	Beta
7/20	5 hrs	3.9	1.3
22	75 hrs	2.9	0.4

FIGURE 1: PHOSDRIN RESIDUE ON SWEET CORN LEAVES
YOLO COUNTY, CALIFORNIA JULY 1976

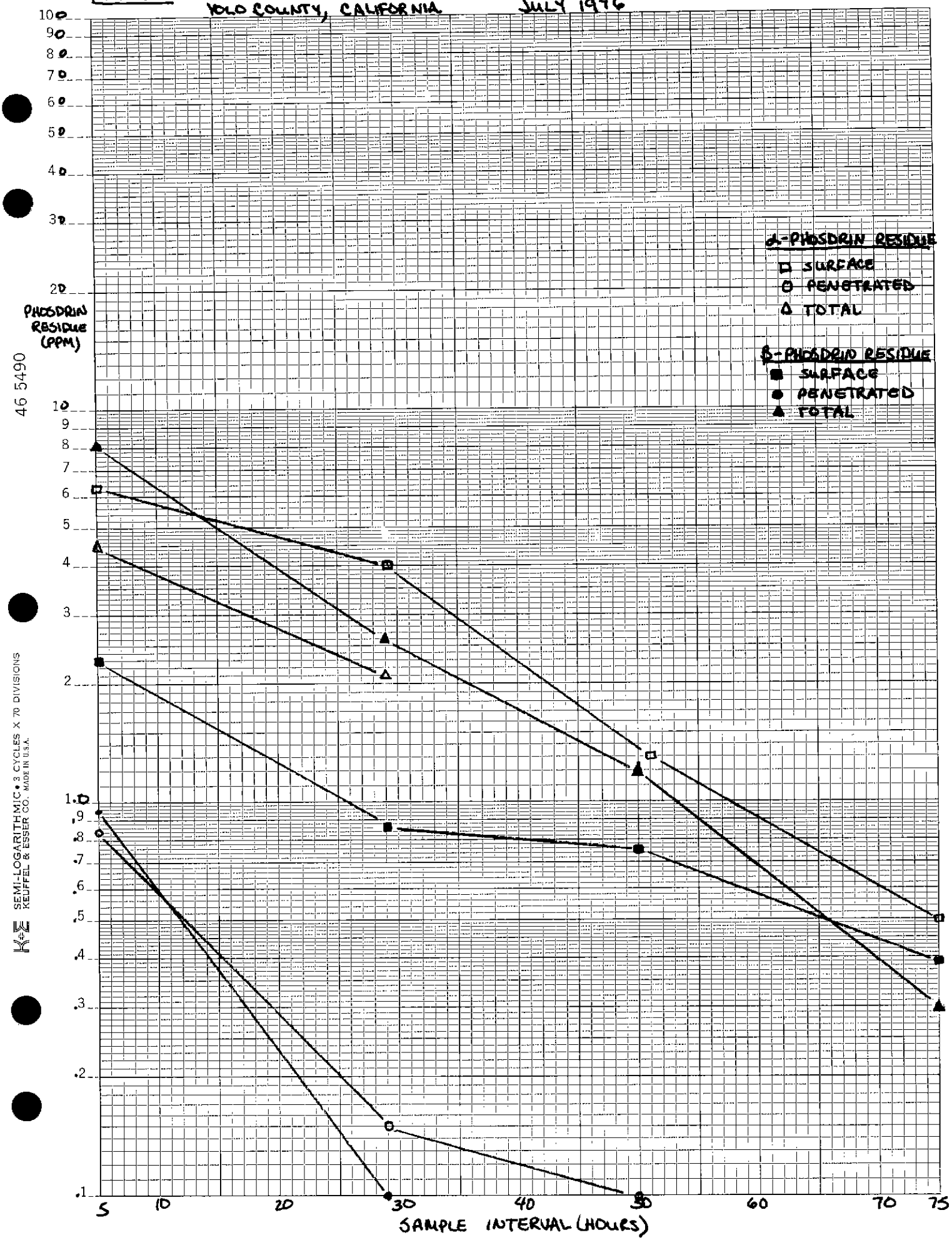

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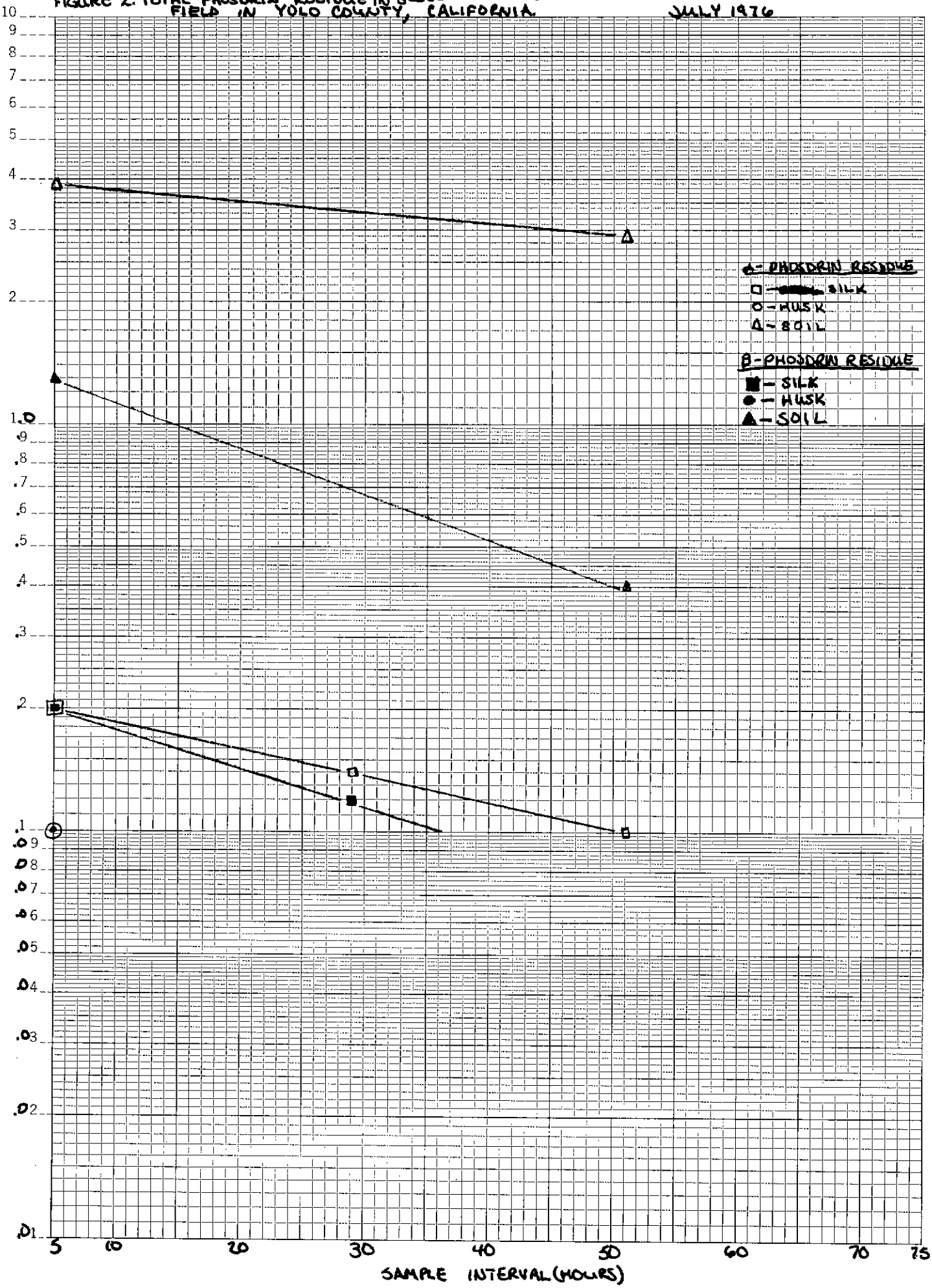
FIGURE 2: TOTAL PHOSDRIN RESIDUE IN SWEET CORN HUSKS AND SILK AND IN SOIL FROM SWEET CORN FIELD IN YOLO COUNTY, CALIFORNIA. JULY 1976



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